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MARYLAND'S OYSTER PROBLEM

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MARYLAND'S OYSTER PROBLEM

Oysters long have held an outstanding place in the economy of Maryland. The value of the industry based on this resource has, for upward of a century, far exceeded that of other fisheries. A total of 2,414,050 bushels of oysters was produced in the State during the 1943-44 season. Though still holding first place among Maryland fisheries, this yield represents less than one-fifth of the quantity harvested annually some sixty years ago when production was at its peak. The loss in potential wealth is enormous. Restoration of oyster production would bring far reaching benefits. It would help solve problems of nutrition by providing greater quantities of a food extremely rich in needed minerals and vitamins. An increased and dependable yield, coupled with modern refrigeration and transportation, would bring this choice food to millions of Americans for whom the present limited supply is unavailable. Employment would be afforded many men and women with consequent social and economic benefit to their communities.

Long continued low levels in Maryland's oyster production, and the apparent ineffectiveness of most past efforts towards restoration, have stimulated much thought and study concerning the underlying causes. It is the purpose of this paper to summarize the facts thus far brought to light, and to indicate some of the information needed in the effort to solve the problem of how best to regain for the State its one time place in the realm of oyster production.

The accompanying chart shows the story of oyster depletion in Maryland. Early seafood statistics were none too accurate and there are gaps in the record. A rapid early rise in production resulted as more and more boats were fitted out to exploit what then seemed an inexhaustible resource. The development of rail transportation and the steam canning of "Cove Oysters" gave stimulus to the young industry. Production reached its height during the decade 1875-1885 with an all time high of 15,000,000 bushels reported for one season. Following this, except for minor fluctuations, the trend was steadily downward until it leveled off at a figure somewhat less than 3,000,000 bushels per year during the past decade.

How was it that Maryland once produced such vast quantities of oysters and now operates on a continuing low level of production? Studies have revealed that, with few exceptions, our oyster producing waters are as rich in food and possess as excellent a chemical and physical environment for oyster growth as ever existed. It is to the life and habits of the oyster and

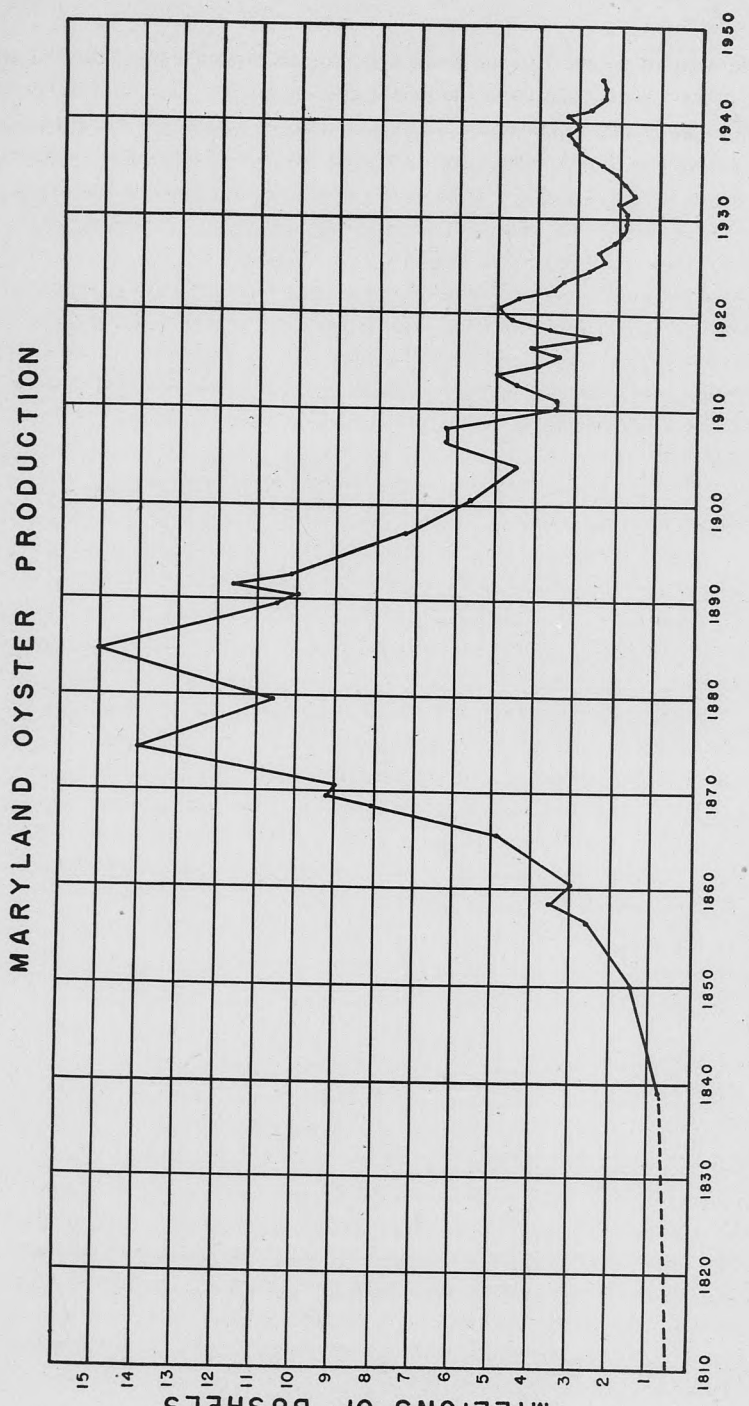
to the ways in which man has dealt with the bars that we must turn in order to find the answer to present day depletion.

The conditions which have so favored oyster growth in the Chesapeake region and the way in which the extensive natural bars or oyster rocks have developed in the past seem fairly clear. Let us first consider the requirements for growth. It is well known that food has its origin in plants which are able, through photosynthesis, to combine simple natural compounds into the complex carbohydrates, proteins, and fats from which all living forms derive energy and substance. Natural waters contain countless microscopic plants which carry on this process of food manufacture. These tiny plants, like the cultivated crops of the farmer, must have supplies of nitrates, phosphates, potassium compounds, and other substances in order to thrive.

The Chesapeake Bay is exceptionally well supplied with the necessary fertilizing compounds. Rain that falls over nearly all of Maryland and most of Virginia, Pennsylvania, Delaware, a large area of New York, and lesser portions of West Virginia, eventually finds its way into the Chesapeake. This water, drained from rich farm land and forest, brings valuable fertilizing elements with it. The farmer's loss is the Chesapeake's gain. Furthermore, unlike the contributions of most other streams, these richly laden waters are not dissipated over wide areas of the sea but, moved slowly by the Bay's sluggish tides, are carried back and forth in this great inland basin and are slowly mingled with the salt water sweeping in and out through the Virginia Capes. Here then is provided an exceptionally favorable environment for abundant growth of those small but all important organisms upon which the larger forms depend for food.

Mud and silt also are carried by streams, especially when in flood. This clouds the water and cuts down the light needed by plants for food manufacture. The Chesapeake again is fortunate in that the lower part of its tributary streams are mostly broad estuaries extending long distances inland from the Bay. Much of the silt is dropped at the head of these estuaries so that the Bay itself is little affected. The greenish-blue cloudiness of the bay water largely results from the myriads of tiny plants and animals which thrive in its waters. However, deposits of silt may be a serious problem in clogging up channels and already to a limited extent have damaged some of the upstream oyster beds. Controlling soil erosion thus will benefit both the farmer and the waterman.

The tiny plants suspended in the water, together with tiny animals which feed upon them, are collectively called *plankton.* It is by straining these organisms from the water that the oyster gets its food. In Chesapeake Bay, the plants and animals of the plankton are normally present in the proper abundance for thrifty oyster growth.


MARYLAND OYSTER PRODUCTION
MILLIONS OF BUSHELS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
1810 1820 1830 1840 1850 1860 1870 1880 1890 1900 1910 1920 1930 1940 1950

Our natural oyster bars or "rocks" are quite extensive and for the most part occupy the deeper flats bordering the channels. The Yates Survey,* 1906-12, showed a total area of 213,000 acres of producing rocks exclusive of the Potomac River. An additional area of 54,000 acres was surveyed in 1914. Since these surveys were made, many of the charted bars have become so depleted that they are no longer in use. In certain cases the rocks themselves seem to have disappeared.

The mass of shells comprising an oyster bar offers the best type of support to living oysters. Here they may firmly attach themselves above the normal shifting sand or mud of the bottom, and are freely bathed in the currents of food bearing water. How did these extensive natural oyster rocks come into being? Observation reveals that it is largely by the oyster's own activity that the bars developed. The life history of the oyster has long been known. Like other complex animals, eggs and sperms are produced by separate sexes. Spawning in Maryland may occur from late spring to early fall. Fertilization occurs in the water and the prodigious numbers of offspring develop rapidly. These swim slowly and drift with the tides during the first two weeks of their lives. At the end of this swimming period, they must attach themselves to some firm object in order to survive. Never again can they change their location.

When ocean waters long ago flooded the valley of the Susquehanna and its tributaries to form the Chesapeake Bay system, it is likely that the bottom consisted largely of mud, sand and stones which, due to the shifting action of wind and tide, rendered most of it an insecure resting place for oysters. It is probable that in the beginning of the Bay's history, oysters occurred only on scattered outcroppings of rock or firm gravel beds along the bottom. From these centers the larvae produced each season were carried by the tides across the extensive barren areas of sand or mud. Some found occasional stones or sunken logs that offered a suitable place for attachment and growth. As they grew to maturity, succeeding generations attached themselves to the older oysters and to the empty shells of those which had completed their span of life and died. Such clusters of oysters gradually spread upwards and outwards forming increasing areas of shell covered bottom. Lateral spreading over the surrounding surface was aided by the effects of gravity, the action of waves and currents, and by the activity of predatory fish and other animals. In this manner it seems likely that the extensive natural oyster rocks were formed over thousands of years. Some of these natural bars have become many feet in thickness so that they rise considerably higher than the normal level of the sand or mud bottom, and are spread over many acres.

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* Survey of Oyster Bars of Maryland, 1906-1912, Charles Yates, Government Printing Office, 1913.

As would be expected, they occupy positions where currents are most favorable in providing food and oxygen for the oyster population.

Why have such natural rocks decreased in area during the years of oyster exploitation? The answer is simple. Each season most of the adult oysters

CHESAPEAKE OYSTER BED SHOWING CULTCH, SPAT AND MATURE OYSTERS

were removed so that their shells did not contribute to the building up or maintenance of the bar. A portion of the old shell to which the oyster attached itself usually is taken up with the oyster. Some watermen are not averse to including as much shell as possible to help fill their measures. In this way the surface of the rock is gradually removed year by year and the remaining portion of older disintegrating shells makes a less suitable cultch for oyster spat.

Years ago some bars were fished so heavily for unculled seed, practically all of which contained a high percentage of shell, that their surfaces were worked down below the level of the soft surrounding bottom. It is likely that in certain locations the annual addition to the rock by the undisturbed natural growth just sufficed to maintain its height above the mud level of the bottom, because of constant silting and, in cases, some sinking. When the level of an oyster bar becomes lower than the surrounding sand or mud it is likely to become covered over during storms. Such bars can be found today, a once productive firm rock beneath a thin layer of soft sand or silt. Either they are totally barren, or only an occasional clump of oysters can be found extending above the mud.

The extent of overfishing and the resulting increase in impoverishment of brood oysters and cultch have been recognized by investigators from the time of the distinguished oyster biologist W. K. Brooks, who published in 1891 a comprehensive treatise covering the biology, cultivation and conservation problems of the oyster.* Most of Dr. Brooks' findings are valid today, and their application years ago probably would have cured many of the ills that continue to harass the industry. A major obstacle to progress has been the widespread attitude that the oyster resources are inexhaustible and that only the vagaries of Nature have caused scarcity or can restore abundance, thus effectively evading responsibility for man's activity as a factor in depletion. The extent and great diversity of Maryland's oyster bars makes the effectuation of comprehensive management plans a problem of great magnitude. Many practical difficulties remain to be overcome and much detailed knowledge of local conditions must be gained before great progress can be expected along the road to full restoration.

Encouragement is to be found, however, in the enactment of several constructive measures and in the increasing consideration now being given to the problem. A cull law was passed in 1890 which set a minimum legal size of two-and-a-half inches for market oysters. The minimum size was raised in 1927 to three inches. This legislation has prevented the destruction of many young oysters such as were formerly wasted. It further has served to raise the quality of the Maryland product. Passage of the cull law was not without opposition and even today, when the benefits of culling operations are widely recognized, pressure is often exerted locally or by special groups to relax the law, and its enforcement remains a major problem.

Annual large scale shelling of depleted bars was begun in 1922 following legislation passed that year. Funds however were meager. An act requiring the oyster packers to place ten per cent of their shells at the disposal of the State for planting was passed in 1927. This same year the Legislature also made available revenues arising from gasoline taxes on work boats together with a small appropriation to be used as an annual rehabilitation fund totalling approximately $100,000. This legislation made it possible to undertake shell and seed planting on a larger scale than heretofore had been possible. Unfortunately, the first major application of shells to a depleted bar provided a poor example for this method of rehabilitation. Certain practical men, dubious of the value of returning shells, insisted that a large test planting be made on a bar which had become totally barren and where fouling of the shells was a serious problem. In the face of scientific advice that, in addition to heavy fouling at this location, brood stock was lacking and no larvae could be found over the bar, the planting was made. It failed to

* The Oyster, W. K. Brooks. The Johns Hopkins Press, 1891

receive a set. Later plantings on certain rocks near the mouth of the Patuxent River and in Cedar Point Hollow, where studies have revealed the existence of favorable conditions, produced good sets and a valuable subsequent crop of mature oysters.

Shell plantings have been continued each year since 1927 from the ten per cent contributed by the packers and through use of the annual rehabilitation funds. No adequate records of the returns from such plantings were made for a number of years. Opinions were at great variance as to their value. Local advice was usually followed as to where shells should be put and in some cases the convenience of the packer in disposing of his shells was given more consideration than the needs of the oyster bottoms. In certain localities oystermen opposed putting shells on any natural rock and forced their planting on mud flats or sand bars. When a careful check of the spat-fall on all plantings was inaugurated in 1940, a distressing picture indicating widespread failure was revealed. With few exceptions, it appeared that the yields from state shell plantings at a time would not be sufficient to cover the cost of the shells.

Occasional bright spots appeared, however, in the scattered plantings which did secure good sets and materially added to the income of local oystermen. Such results have caused a slowly increasing sentiment in favor of shell planting as a general policy. Also, there have been a few years especially favorable to setting when widespread commercial catches occurred on old as well as new plantings wherever these had been placed on good firm bottom. It seems likely that the adoption of the ten per cent shell planting program, with all its limitations, was a considerable factor in checking Maryland's downward trend in oyster yields and in bringing about the slight rise indicated in production statistics of the past decade.

Oyster yields at the present level are far from the State's one time production and even further from the possibilities which are offered through the application of sound cultural practices. It frequently has been demonstrated that man can take wild plants and animals and greatly increase Nature's production with the aid of scientific practices. Foreign countries and some of our own states already have shown that the natural yield of oysters can be improved upon. Detailed information concerning applied oyster farming under diverse Maryland conditions is limited, but enough facts have been gathered to offer a good foundation for sound basic policy and to indicate the problems which need to be solved by future research.

The essentials of oyster culture at first seem to be simple. (1) Hard, non-shifting bottoms must be available where clean salt water, bearing adequate food organisms, circulates over the beds. (2) Brood stock must be present in sufficient quantity to supply the necessary larvae. (3) Adequate cultch

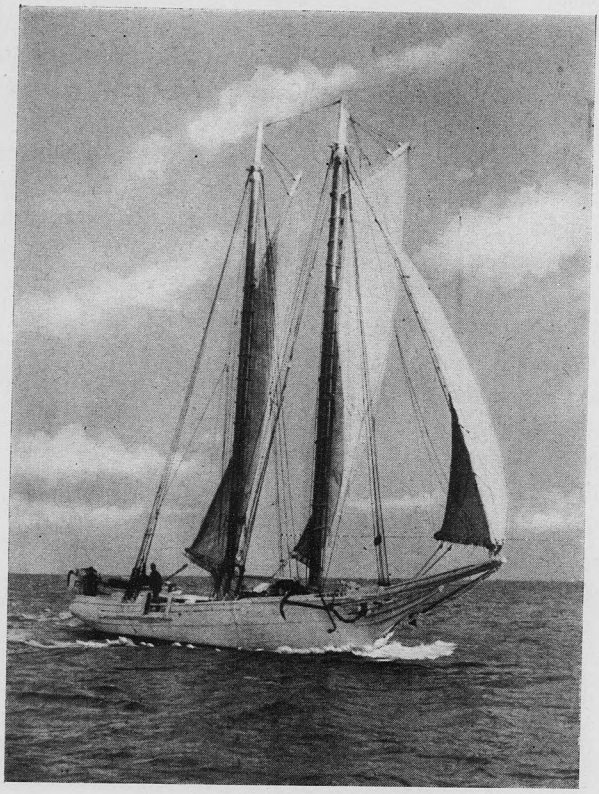
(shells) must be present to offer clean firm surfaces at the time the larvae are ready to set. (4) The resulting spat or "seed" must be present in the proper concentration to produce the best growth of fat, well shaped oysters. (5) Harvesting should be done at a time when the oysters have reached the optimum size and condition for marketing. (6) The oyster bars must be comparatively free from oyster enemies and competing organisms. These listed essentials, however, become more complex when applied to local conditions.

Maryland is abundantly supplied with suitable bottoms and water for oyster growth. Even those natural rocks which have been made barren and are covered with silt can be rebuilt upon the firm foundation they still offer. Additional areas that have never produced oysters can be built up as private planters have demonstrated. There is need, however, for detailed information concerning the exact condition of all the natural and potential bars throughout the State. Only through such knowledge can the individual rocks be most effectively used.

Brood stock is present in greater or lesser abundance throughout most of our oyster producing waters. It is known that oysters grouped closely together stimulate one another to spawn and result in more extensive fertilization of the eggs than is possible when the same quantity of oysters is scattered over a wide area. The State already has utilized such knowledge by planting belts of adult oysters adjacent to large shell plantings where insurance of brood stock has seemed necessary. Additional information is needed, however, concerning the abundance of natural brood stock, the exact amount of brood oysters required for a given acreage, the distance to which larvae are dispersed, and the best position of brood oysters with reference to the cultch. It is likely that different answers will be found in the various regions of the State since currents, salinities and temperature ranges are known to vary greatly.

Providing clean cultch at the time when larvae are ready to set has been found a difficult problem. Oyster shells thus far have proved to be the most effective cultch material in Maryland waters. It has been shown that shells may become covered so rapidly with certain tiny animals and plants that in some localities no shell surface suitable for oyster attachment is left after only three weeks of immersion. In other waters of the State such fouling growths are slow, and some shell surface may be left clean even after a year of exposure. If shells could be planted at the time setting is about to occur, then fouling would present no serious problem. However, setting in Maryland has been found to take place anywhere from late May to mid-October and, in addition, it varies from place to place and from season to season. Detailed study of the individual areas to be shelled should be undertaken in

an effort to find out the nature and rate of fouling and to make possible the prediction of the time of oyster setting.



OYSTER DREDGE BOAT

Formerly over 1200 such vessels engaged in dredging oysters from Maryland waters. Now approximately one tenth of this number work the depleted bay oyster rocks.

Other problems arise and much further information is needed in connection with the securing of adequate set. Studies of larvae concentration and distribution over the beds are needed throughout the season. The best concentration of shells and whether they should be broadcast or placed in windrows should be discovered for each bar. The extent that spat can be expected to survive in different shell concentrations and in different localities should be known. The fact that certain areas usually receive good sets year after year while others seldom receive any set at all has been learned through observation of the results from past shell plantings. On the basis of such information recent shell plantings have been centered on those areas that

have demonstrated good setting conditions, while the planting of shells has been abandoned where sets consistently have been poor. Much more information is needed on the extent of the natural set and the conditions to be found on the many diverse oyster rocks of the State.

In many cases, oysters of better quality are produced by private planters who have learned through experience just what concentration of seed will make for best growth and quality on their oyster farms. Experimental studies of oyster growth and fattening under diverse conditions would be of value both to the State and to private planters. The extent to which growth is checked or mortality results through transplanting oysters of different sizes and at different seasons of the year should be a part of such studies. Records also should be obtained on the mortality and growth of oysters resulting from all different methods of handling and planting seed.

A good farmer does not slaughter his hogs when half grown or dig his potatoes before they are mature. Neither does he keep them after growth has slowed down and the deterioration of old age has commenced. Likewise, oysters yield the best return only when harvested at the proper size and season. On different bottoms oysters grow at different rates. The seed areas where sets are heavy usually produce few market oysters and small oysters are often found to be quite old. When transplanted to other bars, growth may be rapid. The optimum time for harvest is when the greatest returns from the planting can be made as expressed in terms of annual increment. This should be studied experimentally in various locations.

The nature of the planted bar, source of seed, extent of salinity changes and other physical factors, all have their effect on oyster growth. By the addition of shell or other material to improve the bottom and maintain its level, the yield of certain rocks can be increased. Controlled planting of seed from waters of both high and low salinities and from other states, north and south, should be made in various parts of Maryland and the yields compared. The application of commercial fertilizer in isolated bodies of coastal water has yielded promising results in Europe and might prove of value under certain distinct conditions locally. Great possibilities even may lie in selective breeding to produce the best type oyster for the particular environment. Such abstract problems should be approached along with the application of tried and tested procedures such as those already indicated.

Maryland is fortunate in her general freedom from some of the oyster's worst enemies. The arch enemy of the Northern planter, the star fish, is not found in our waters. The screw borer is limited by salinity to small areas in Somerset County and to Chincoteague Bay. There it is very destructive, and a study of the control methods best suited to local conditions should be made. The depredations of certain fishes, the boring sponge and a protozoan para-

site (*Nematopsis*), and the competition with mussels, sea squirts and other organisms have thus far been minor problems. A careful check of the distribution of such pests should be made yearly and the use of badly infested bars for planting or transplanting purposes should be judged accordingly.

Recent legislation has given the State authority to establish seed areas, transplant seed across county lines, and close planted areas until the oysters have reached the desired size. Taxes levied on oysters harvested from planted areas are intended to make the cost of these operations self-supporting. Detailed management plans have been announced by the Department of Tidewater Fisheries, under which the gradual restocking and subsequent handling of barren and depleted bars, according to the best methods of modern oyster farming, are envisaged.

It is difficult to carry on a publicly operated enterprise with as high a degree of efficiency as can be obtained under a system of private management. Maryland sentiment in the past, however, has been overwhelmingly in favor of public ownership of our natural oyster rocks and has successfully opposed all attempts to permit the restoration of depleted bars by private initiative. Limited private oyster farming on bottoms other than natural rocks has been legalized and in some instances has met with success. The marked success of private enterprise in developing the oyster resources of other states unquestionably merits further attention and encouragement on the part of oystermen and conservation administrators in Maryland.

The U. S. Fish and Wildlife Service is cooperating with the Department of Research and Education and the Department of Tidewater Fisheries in a more widespread gathering of the data necessary to the management of Maryland's oyster resources. Many years of able and determined leadership in the application of such information will be needed before all of the barren and depleted bars can be restored. Enforcement of regulations found necessary for the carrying out of a comprehensive rehabilitation program must be made effective. Better policing and more certain and speedy conviction of law violators, than have existed in the past, are urgently needed.

Public backing, especially on the part of the oystermen and packers, is essential to the success of any restoration plans, either those current or those yet to be formulated. Accurate information must be widely disseminated as to the true facts involved and the reasons for undertaking specific remedial measures if an intelligent public opinion is to be made possible. To this end, an educational program is being developed to keep the public informed as to the nature of the problems that exist and the facts which must be considered in formulating policies for the wisest use of all of our various natural resources.

Progress towards the solution of Maryland's oyster problem is evident today in the careful working out of plans by administrative leaders who are seeking to use all factual information available, whether from practical experience or the result of scientific research. Provision has been made for the gathering of additional pertinent information on a much wider scale than has been possible in the past. Modification and reformulation of administrative policy in the Department of Tidewater Fisheries is planned as experience and the discovery of additional facts may indicate. The policy of oyster management now employed has begun to show constructive results and, though some years will be required for it to effect large scale restoration, there is reason for increased hope that the painstaking thought and effort of the many individuals who have pointed the way toward rehabilitation of the oyster industry will bear fruit. Eventual production far in excess of our previous best yields does not appear to be an impossible goal.

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